Atty. Docket No. Q64544
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. §1.111
U.S. Application No. 09/856,362

AMENDMENTS TO THE DRAWINGS

Add Figs. 3b-3e.

Attachment: Replacement Sheet(s)

REMARKS

Claims 1-8 and 10-25 are all the claims pending in the application, claim 9 having been canceled and certain of the remaining claims amended. Reconsideration of the application and allowance of all claims are respectfully requested in view of the above amendments and the following remarks.

The present invention is directed to a broadband transmission system, and the problem addressed is the need to compensate for distortion caused by the Raman effect. The inventors have noted that in a broadband system the distortion is generated by crosstalk between adjacent channels, so the invention provides compensation for inter-channel energy transfer as a way of reducing distortion. Fig. 1 represents a transmission system having a 500 nm (1200nm-1700nm) bandwidth. A first zone covers the first 13 THz to 21 THz (or about 70 nm to 120 nm) of the bandwidth, The third zone is about the same width as the first zone, covering the last 13 THz to 21 THZ (about 70 nm to 120 nm) of the available bandwidth up to the upper limit of 1700 nm. The second zone is everything between the first and third zones.

In the first zone, the channels are subject to depletion caused by the Raman effect, so their gain is below nominal. The energy lost in the first zone is transferred to channels in the second zone, but there is also energy transfer from channels in the second zone to channels in the third zone, and the net effect in the second zone is not so significant. On the other hand, energy transfer from the channels of the second zone to channels of the third zone results in a gain in the third zone that is above nominal.

As discussed at page 8 of the specification, the distortion phenomenon illustrated in Fig. 1 does not exist in conventional narrow bandwidth applications, but does exist when the bandwidth reaches on the order of 250 nm.

According to the invention, distortion is compensated in multiple ways. As shown in Fig. 2 and described at page 9, in the first zone the invention proposes the use of amplifiers having gain that is greater than the average gain in order to achieve a gain in this zone that decreases substantially linearly. The preferred implementation is distributed amplifiers. In the third zone, the gain is to be less than the average gain and will also decrease substantially linearly. This can be accomplished by using amplifiers with lower gain but can also be accomplished by extending the operating range of the system to longer wavelengths and making use of the increased linear attenuation at those wavelengths.

The Examiner has rejected claim 10 under 35 U.S.C. 112, first paragraph. Applicant has amended claim 10. It is well known in the art how to control the power of signals in a transmission system. The ordinarily skilled artisan would have no trouble whatsoever in designing the system so that the power of the channels at the end of the band would be less than in the remainder of the band, as is described at the top of page 10 and reflected in claim 10. Accordingly, it is respectfully submitted that the subject matter of claim 10 is enabled in the specification as originally filed, and withdrawal of this rejection is respectfully requested.

The Examiner has objected to the drawings filed on May 22, 2001 under 37 C.F.R. 1.83(a). In response to the prediction of similar objections in an Office Communication dated

July 8, 2004, Applicant filed Fig. 3 illustrating the compensation means on August 9, 2004. Here, Applicant has added Figs. 3b-3e, illustrating the distributed amplifiers, Raman amplifiers, rare earth amplifiers and power control respectively.

Claims 1, 5, 11 and 14 stand rejected under 35 U.S.C. 102(b) as being anticipated by the French patent No. 99/07324 described in the specification. Claims 1, 5, 7, 10-11, 14, 16, 18-19 stand rejected under 35 U.S.C. 102(b) as being anticipated by USP 6,088,152 to Berger. Claims 4, 9, 21-22 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Berger. Claims 2-3, 6, 8, 12-13, 15, 17, and 20 stand rejected under 35 U.S.C. 103(a) as being unpatentable over USP 6,611,369 to Matsushita in view of Berger. Claims 2, 6, 8, 12, 15, 17 and 20 stand rejected under 35 U.S.C. 103(a) as being unpatentable over USP 6, 356, 384 to Islam in view of Berger. Applicant respectfully traverses these rejections, and requests reconsideration and allowance of the pending claims in view of the following arguments.

Claim 1 of the present application recites a very broad band wavelength division multiplexed transmission system comprising optical media for carrying signals subject to a Raman effect, said system further comprising means for compensating energy transfers between channels caused by the Raman effect over the very broad band.

The very broad band is defined in the specification as wavelength ranges that extend over more than 150 nm or more than 200 nm, i.e., over more than 20 THz or more than 30 THz (Specification, page 4, the second paragraph). However, none of the cited references is related to such a very broad band.

1. French Patent Application No. 99/07324

The French patent application No. 99/07324 is proposed for signals at wavelengths lying in the range of 1520 nm to 1600 nm, i.e., over bandwidths that are generally less than 80 nm to 100 nm, and that are at most equal to 20 THz (Specification, page 3, the first full paragraph, the last sentence). Thus, this French patent fails to teach the very broad band and the very broad band wavelength division multiplexed transmission system of claim 1.

2. Berger

Berger provides a system for compensating for the effect of the Raman tilt by generating a gain that is pretilted opposite to the Raman tilt. However, the Berger amplifier is only applied to a bandwidth of about 40 nm (Berger, Figs. 1 and 5), much narrower than the very broad band of in claim 1.

In addition, Berger's amplifier is a lump amplifier of the rare earth doped fiber type, not a distributed amplifier. As shown in Fig. 4, the Berger amplifier comprises two stages: an input stage comprising an isolator 5, a doped fiber 10 and a wavelength division multiplier (WDM) 15; and an output stage comprising a WDM 40, a rare-earth doped fiber 45 and an isolator 50. An adjustable attenuator 30 between the two stages allows adjustment of the population inversion in the doped fiber of the output stage. The gain of the Berger amplifier gives a response which compensates more or less the Raman tilt produced in the fiber of the link.

The invention of claim 1 concerns a very broad band for which no existing means can amplify simultaneously all the channels. In other words, an optical lump amplifier having a bandwidth over 150 nm does not exist. Consequently, Berger's amplifier cannot be applied to the very broad band in claim 1.

The present application mentions in several places that the distortion caused by the Raman effect in very broad band systems is different from the distortion caused by the same Raman effect in conventional WDM transmission systems (Specification, page 6, lines 4-8; page 8, the second full paragraph, the first sentence; and page 8, the third full paragraph, the first sentence). The purpose of the claimed invention is to compensate the distortion caused by the Raman effect in the very broad band system. Because Berger is not related to the very broad band, it does not give a solution to the problem of the present application.

Thus, Berger fails to teach the very broad band wavelength division multiplexed transmission system of claim 1. None of other cited references supplies Berger's deficiencies.

3. Matsushita

Matsushita provides an optical signal amplifier with a depolarizer. According to Matsushita, fluctuations in the polarization inputs to a Raman amplifier cause the relative orientations of the electric fields to vary and produce fluctuations in the gain of the amplifier, and such fluctuations in the gain increase the likelihood of errors in transmitting information over optical fibers (Matsushita, col. 1, the second paragraph). Thus, Matsushita provides a

depolarizer to solve the problem. As shown in Fig. 1B of Matsushita, a depolarizer 14 receives linearly polarized light from a light source 12, and at least partially depolarizes the light.

Given the different problems solved by Berger and Matsushita, there is no reason or suggestion to combine the two references.

In addition, Matsushita does not teach the very broad band either. Thus, even if a skilled artisan were to combine the two references, the combination would not result in the invention of claim 1.

4. Islam

The filing date of USP 6,356,384 to Islam cited by the Examiner is April 11, 2000, later than the priority date of the present application, September 23, 1999. USP 6,356,384 is a continuation-in-part of U.S. patent application No. 09/470,831, filed on December 23, 1999; a continuation-in-part of U.S. patent application No. 09/471,752, filed on December 23, 1999, and a continuation-in-part of U.S patent application No. 09/046,900 filed on March 24, 1998. Thus, only what is disclosed in U.S patent application No. 09/046,900, which has matured into USP 6,101,024 (the '024 patent), can be used as prior art against the present application.

The '024 patent provides an optical amplifier for a range of wavelengths between about 1430 nm and 1530 nm, or with 100 nm bandwidth. The amplifier is implemented by using a combination of cascaded Raman amplification and either parametric amplification or four-wave mixing in optical fibers.

The '024 patent does not mention the correction of Raman effect at all. Thus, there is no reason or suggestion to combine Berger and the '024 patent.

In addition, the optical amplifier of the '024 patent is used for a bandwidth of only about 100 nm. Thus, the '024 patent does not supply Berger's deficiencies. Even if a skilled artisan were to combine Berger and the '024 patent, the combination would not result in the invention of claim 1.

Thus, claim 1 and its dependent claims 2-8, 10, 21 and 22 are patentable.

Claims 11-20 and 23-25 are patentable for the same reasons.

Further, Berger's amplifier is a lump amplifier. However, claims 16-18 recite distributed application means, and claim 25 recite compensation means attenuated the enrichment of the channels over the end of the very broad band in a distributed way. Thus, claims 16-18 and 25 are patentable for this additional reason.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

Paul J. Wilson
Registration No. 45,879

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
23373
CUSTOMER NUMBER

Date: January 24, 2005

Certificate of Mailing

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to:

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Date: January 24, 2005
Signed:
Mariann Tam